

MISSOURI

resources

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INNOVATIONS  IN ENERGY

Director's Comment

The Martin family planned a stop at a Missouri state park, just as hundreds of thousands of Missourians do each year. The visit to Lake of the Ozarks State Park was a chance for 5-year-old Jessica Martin to stretch her legs in the middle of a long road trip. Hours later, though, they made a startling discovery – their faithful traveling companion had been left behind.

Beary, Jessica's much-loved teddy bear, was still somewhere inside that park, and although the majestic Missouri outdoors is the perfect setting for a diverse range of wildlife, the Martin family couldn't bear to part with this dear old friend.

Jessica's father, Bob, made a call to Lake of the Ozarks State Park. The call went to Dave Stark who is an experienced park ranger, as well as a father and grandfather. Stark undertook a search and rescue effort. Beary was returned, along with photos of his trip to the state park, an honorary ranger badge and a note encouraging Jessica to consider a career as a state park ranger.

I hear countless tales like this, like a letter from Martie Lenk, thanking our staff for helping students at the Kansas City Scuola Vita Nuova Charter School train for and participate in our annual bicycle ride through Katy Trail State Park. Being from an urban area, many of these students had never had the opportunity to experience Missouri's natural areas; some didn't know how to ride a bike. A team of state park employees worked together to help the students prepare for the adventure and supported them during their journey.

Many of us are familiar with studies that show the significant positive economic benefits that state parks generate and their value as a way to stay fit, reconnect with nature and create family bonds. But what sets our state park system apart is the high level of quality service provided by its employees. Unfortunately, with the recent decline in the economy, revenue collected through the tax that funds the state park system has also dropped dramatically, creating new



challenges for our state park system. We recently were forced to lay off 48 valued state park employees – each one of those employees was like a member of our family, and their loss is felt immeasurably.

On the October day the Martins called Lake of the Ozarks State Park it was short-staffed, but Dave Stark responded to the call, anyway. Despite the challenges facing his state park – and the whole state park system – Stark understood the importance of that bear and that visit. He knew that this simple act was an opportunity to reach out to one little girl and to show her the inherent joy that accompanies a day in Missouri's great outdoors. In the process, Park Ranger Stark reminded us all of the quality customer service that can be expected when we visit a Missouri state park. State park employees like Stark and his co-workers are working hard to maintain this level of service, despite cutbacks. These stories also serve as a reminder to all Missourians that, as the sign at every state park reads, "You Are Always Welcome in Missouri State Parks."

Mark N. Templeton
Missouri Department of Natural Resources

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A Smart Approach to Smart Grid Development

by Alex Wendel

A 150-block area of Kansas City's urban core has been designated as the Green Impact Zone. Partially funded by the federal Recovery Act, the effort will use the area to test emerging energy technologies, products, equipment and processes.

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On the Farm, Off the Grid

by Kerry Cordray and Kathy Deters

It might be known as "the last road in the county," but Brad Ficke's century-old farm was the first to solarize its stock-watering operation.

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Fill 'er Up ... on Fries

by Andrea Morrow

Enterprising students and teachers at Truman State University took waste vegetable oil and turned it into fuel. With some funding help, they now plan to generate 5,000 gallons per year.

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Rolla's Extreme Energy Makeover

by Hylan Beydler

In five years, the Department of Natural Resources' Division of Geology and Land Survey in Rolla has cut their main facility's energy use by as much as 40 percent.



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Winds of Innovation ... With a Blast From the Past



Above right: Plumbing for a solar-heated hot water system is functional art.

Above: Reflected light creates patterns on the water at Ha Ha Tonka Spring in Camden County.

COVERS: Ice-covered grass sparkles above a late winter snow.

Cover photo by Scott Myers.



A SMART APPROACH

to Smart Grid Development

by Alex Wendel

Rarely does a community get the opportunity to rebuild and reinvest in entire neighborhoods within its urban core. That makes what is currently happening in Kansas City so unique. With the help of federal stimulus funding from the American Recovery and Reinvestment Act, a diverse and broad coalition of more than 20 organizations is working together to rebuild a 150-block area of Kansas City's urban core, an area known as the Green Impact Zone.

"Typically, green investments have been reserved for those who can afford the upfront cost. In neighborhoods like these, where the median income is less than \$20,000 a year, 'greening' is simply not possible," explained Congressman Emanuel Cleaver II, who represents Missouri's 5th Congressional District. "This plan removes that burden and reduces the utility bills for those who need it

most. With job training, neighborhood stabilization and infrastructure investments targeted here, 'green' is no longer an academic concept for someone else – it becomes a means to change peoples' lives right here in our urban core."

A key piece of the Green Impact Zone initiative is Kansas City Power and Light's proposal to deploy a fully integrated smart grid demonstration project. A smart grid uses advanced technology to establish real-time, two-way communication between the utility and the customer. The resulting information flow allows for improved energy efficiency, reduced cost and improved reliability.

One of the elements that makes KCP&L's smart grid project so unique is that it is part of a coordinated effort to integrate various Recovery Act stimulus-funded programs in a targeted urban area. The goal is to encourage community revitalization and en-

hance the area's sustainability, public safety, housing conditions, access to jobs and overall economic vitality.

The total project is expected to cost more than \$48 million, half of which is being paid for with stimulus funding through the U.S. Department of Energy. KCP&L, working with a coalition of smart grid industry partners, is planning to contribute an additional \$24 million. Though covering a slightly larger area than the Green Impact Zone, the focus for the smart grid project will be on the neighborhoods roughly bounded by Main Street on the west, Swope Parkway on the east, 37th Street on the north and 52nd Street on the south.

"KCP&L has always sought ways to support development in the urban core, so this project makes a lot of sense for us," said Mike Chesser, chairman and CEO of KCP&L. "The utilization of advanced smart grid technology is the start of a two-way



conversation with our customers. The project will benefit not only the residents of neighborhoods within the Green Impact Zone, but also our entire service area ... [it has] major implications for KCP&L's future and the future of our entire industry."

Within the Green Impact Zone, the smart grid project will enable the utility to test emerging technologies and evaluate next generation products, equipment and processes. By gathering information about customer needs, KCP&L will be able to demonstrate to those same customers the benefits of the advanced utility of the future – specifically, how demand-side management, energy efficiency, demand response and energy storage can all work together.

Efforts in the Green Impact Zone will focus on three areas: smart generation, smart distribution and smart consumption.

Smart Generation: Most of the electricity we use comes from coal-fired power plants. Within the Green Impact Zone and surrounding areas, KCP&L will work with

select residents, businesses and schools to pilot cost-effective technology, such as rooftop solar systems and battery storage. These innovative resources will be used to add renewable energy while supporting the grid for reliability.

Smart Distribution: KCP&L's distribution system is made up of miles of power lines and hundreds of substations that move electricity to customers' homes and businesses. While KCP&L has already implemented a number of smart applications – such as automated meter reading, smart switches and smart capacitors – the smart grid project will further improve distribution through the use of advanced technologies, such as a smart substation at 48th and Troost streets. Smart grid monitoring and automation also is planned.

Smart Consumption: Educating customers and giving them the tools to manage their electricity usage and monthly bills are essential components to the success of the

(Above) A panoramic view shows a street within Kansas City's 150-block Green Impact Zone. The urban core neighborhood will be the focus of widespread improvements designed to allow low-income families to participate in the benefits of green businesses.

DNR photo by Scott Myers.

(Inset) Linemen from Kansas City Power and Light will work on improvements to electric power distribution lines as a basic part of the smart grid system being installed in the Green Impact Zone.

Photo by Blake Lyndall, Kansas City Power and Light.



(Top) Congressman Emanuel Cleaver II speaks at a Nov. 24, 2009 press conference announcing a nearly \$24 million grant to KCP&L for implementation of the utility's smart grid demonstration project. (Bottom) Kansas City Power and Light linemen will soon hold lofty discussions on installing upgrades that will be part of a smart grid system, allowing customers to have greater control over their management of electricity use.

project. KCP&L will focus on updating the area's metering system to accommodate smart appliances, time-of-use pricing options and advanced residential and commercial energy management systems. These systems give customers greater control over how they monitor and manage their electricity usage.

The smart grid project will allow utility customers in the Green Impact Zone to take advantage of KCP&L's full portfolio of energy efficiency products and services, including rebates for high-efficiency air conditioners, incentives for compact fluorescent lighting, weatherization programs, home energy audits, programmable thermostats and commercial rebates for

improvements in lighting and efficiency. In addition, the Green Impact Zone will pilot LED security lighting, high-efficiency heat pump water heaters, super-efficient appliances, 10 hybrid electric vehicle charging stations, and thermal and battery storage.

As Green Impact Zone customers are exposed to these innovative products and services, they will learn how to manage their electricity demand and consumption to save energy and money. Their use of smart technologies will also enable KCP&L to manage demand, defer the costs of expensive power plant construction and enhance the performance and efficiency of its transmission and distribution grid.

In addition to making the latest in energy efficiency and technology available, the utility also intends to work closely with the community on promoting workforce development initiatives.

"We intend to partner with local and regional organizations to provide green job training," said Chesser. "We'll also be working with the neighborhood schools, providing them with lesson plans on electricity, green jobs and energy efficiency, as well as information for students on career opportunities at Kansas City Power and Light."



Photo by Blake Lyndall, Kansas City Power and Light

There are numerous organizations contributing resources and funding to ensure that the Green Impact Zone is a success, including the State of Missouri, Mid-America Regional Council, the City of Kansas City, Brush Creek Community partners, University of Missouri-Kansas City, the Metropolitan Energy Center and several neighborhood associations. KCP&L also has brought a number of best-in-class industry partners to the table, including, Siemens, OATI, Landis+Gyr, Intergraph, GridPoint and Kokam America.

“KCP&L has demonstrated a long-standing commitment to community engagement, to bringing together diverse stakeholder groups to develop regional energy solutions,” said Margaret May, Executive Director, Ivanhoe Neighborhood Council. “We are very thankful they are in a position to propose this demonstration project at this time, in this location and with this collection of community partners.”

Although KCP&L’s smart grid demonstration is just one part of the proposed \$200 million Green Impact Zone project, the effects will ultimately have regional ramifications. This all-inclusive project allows exploration of renewable, energy-efficiency and operational options. Rather than focusing on only one aspect of the smart grid, the Green Impact Zone achieves greater value by testing a number of advanced technologies and evaluating them with customers. The information collected will provide a significant regional advantage when competing for federal and private investment capital.

It will take three to five years to build the smart grid portion and implement the job training and programs. The result will be a community asset that strengthens businesses and families in the Green Impact Zone, helps the entire region and builds a knowledge level that will allow KCP&L to expand green technologies to the remainder of the company’s 800,000 customers.

For more information, see [\[kcpl.com/about/policyctr.html\]](http://kcpl.com/about/policyctr.html). ☀

Alex Wendel is with Global Prairie, a marketing communications firm in Kansas City. He has worked with KCP&L for more than five years.

(Right) Home-based automation technology, along with distribution system improvements, will help residents increase energy efficiency and reduce costs.



DNR photos by Scott Myers



On the Farm, Off the Grid

by Kerry Cordray and Kathy Deters
photographs by Scott Myers



When part of your farm is on the “Last Road in the County,” self sufficiency is a plus.

Since 1991, Brad Fricke has farmed land that has been in his family since the 1860s. Fricke’s farm consists of several parcels of land, one located just north of Hermann on a road known as the “Last Road in the County,” that consists of 300 acres of row crops and between 300 and 400 head of cattle on 150 acres of pasture.

In 2005, Fricke decided to add the latest in solar-powered technology to the more than century-old farming operation. For the past four years, a solar-powered system has pumped water for all his cattle from a pond that recharges underground from the Missouri River. The system is capable of pumping 120 gallons of water per minute to 11 tanks in each of 22 four-acre paddocks. This system enables Fricke to use rotational grazing, which reduces erosion and spreads nutrients. By excluding livestock from sen-

sitive stream bank areas, rotational grazing reduces erosion near stream banks by keeping the animals from trampling the fragile stream bank vegetation, and moves animal waste runoff further from the banks of surface waters.

“The availability of electricity is what got it started,” Fricke said. “We had an area that had been affected by floods in ’86 that wasn’t producing what we wanted in terms of row crops, so we wanted to put livestock on those acres.”

Unfortunately, it was cost-prohibitive to run traditional power lines to that area of the farm. Fricke’s father happened to meet Henry Rentz with Missouri Valley Renewable Energy and suggested Brad contact him.

“I told my dad I didn’t think it was possible for a solar-powered system to pump 10,000 gallons of water per day, which is what we needed,” Fricke said.

Fricke’s father recommended he contact Rentz anyway. Rentz was able to put together a solar system that met Fricke’s water pumping needs as well as powering an electric fence.

With this portion of Fricke’s family farm being more than a half mile from AmerenUE’s system, it would have cost him \$18,000 to run utilities to his property and dig a well. The total cost of the solar system was about \$32,000, which was largely offset by \$15,000 in grants Fricke received through a previous program administered by the Missouri Department of Natural Resources’ Energy Center.

Renewables and Rural Realities

Like Fricke, many Missourians have become interested in home energy generation from the wind, the sun and other renewable resources. Some are wisely looking to diversify the source of their energy supplies in order to be less dependent on a single energy source. Others yearn for personal independence from utility-provided energy sources, longing to “cut the cord” that binds them to public providers of electricity, gas or transportation fuels. Others still are simply passionate about the “coolness factor” of renewable energy, the undeniable allure to the notion of snatching power from the sky and the associated environmental benefits of producing it cleanly.

The fire of this fervor is often cooled by physical or economic realities, however. Many who look to solar or wind generation find themselves unprepared for the cash in-

vestment required to purchase and install a renewable system. Others find their local wind or solar resource insufficient to meet their power needs, or that the renewable system they envision isn’t cost-effective when compared to a lower energy cost from the local utility company.

In many cases, though, the option of wind or solar power turns out to be a cost-effective choice. This is especially the case in rural areas where building a renewable system may be cheaper than the cost of installing and connecting new power lines to a site distant from the local utility’s nearest service lines.

“A guideline we often give is to seriously consider a renewable system when your site is more than a half mile from the utility lines,” said Roger Korenberg, environmental engineer for DNR’s Energy Center. “It’s also important to remember when you are thinking about solar or wind, that investing in energy efficiency first saves the property owner in the long term. A kilowatt saved is one you don’t have to pay to produce, regardless of whether you use wind, solar or other renewable energy sources.”

Renewable energy technology can be used for numerous other potential applications in agricultural operations. Solar or wind power systems may be used on the farm for greenhouse ventilation, irrigation systems, pond aeration, gate openers and security lighting. According to Bill Loesch, owner of Solar One in St. Louis, with many farmers facing wet crops and the potential for rot after the heavy rains of 2009, solar technology enabled some producers to dry grain themselves without having to pay a third party.

“The individual farmer making use of solar hot air was able to save a significant portion of the cost that they would be paying to a commercial grain middle man,” Loesch said.

Rentz notes that renewable energy also provides users reliability when utilities may be at the mercy of severe weather.



(Opposite page, top) Farmer Brad Fricke stands near a stock tank on a remote part of his farm. The tanks are filled by a pump using solar power rather than a local utility line.

(Opposite page, bottom) Fricke moves one of his solar-powered irrigation sprayers.

(Above) A 12-panel solar array supplies the livestock watering, fencing and irrigation needs with efficient energy.



Fricke ear-tags a newborn calf as its concerned mother pays close attention. (Below) Grazing cattle are never too far from water on the remote Fricke farm.

“We don’t go down in a storm like the utilities do from time to time,” Rentz said. “As a matter of fact, the reason I got in the business in the first place was due to a six-day ice storm and power outage. I thought to myself, ‘there has to be a better way.’”

System Types (descriptions adapted from *Homepower* magazine)

If you dream of “cutting the cord” from your utility provider, become familiar with the available options first – and understand the costs and limitations that exist. Three basic categories of renewable electricity systems are available today: “Every renewable

resource follows the same principle; you’re paying up front for years of use downstream,” Loesch said.

Batteryless Grid-tie Systems are the simplest systems because they have only energy generation technology (solar photovoltaic modules, wind or microhydro turbines) and an inverter connected to the utility grid. They have no batteries, which points to their primary drawback—no backup capability. When the grid goes down, these systems also shut down.

Stand-alone Off-grid Systems are fully independent of the utility grid. With the exception of direct-use systems like water pumping or PV-powered ventilation, stand-alone systems require batteries to provide power storage during times of high usage or low input.

Battery-based Grid-tie Systems

are similar to standalone systems. They also use batteries, but are connected to the utility grid, so they can use utility electricity when needed and send any surplus electricity generated by the system out to the grid.

While renewable electricity has lots of benefits, stand-alone (off-grid) systems are more expensive and complex, and require more maintenance than batteryless grid-tied systems. According to Rentz, going off-grid requires users to change their way of thinking; they must be aware of their storage capacity and conscious of their energy usage at all times. Rentz also said many customers are surprised at the cost of installing the systems. Renewable energy systems installed on the grid offer real advantages.

Fricke’s farm is powered by a Grundfos system, which has a 1.8-kilowatt system capacity that consists of 12 150-watt panels. Rentz helped Fricke choose a system that was best suited to his particular operation. Rentz emphasizes the importance of choosing solar panels that are appropriate for the specific application. The decision is not a one-size-fits-all prospect.

“It’s not a cookie-cutter thing where they are all the same,” Rentz said. “Each system should be custom designed to meet your particular need.”

In addition to solar-powered watering systems like Fricke’s, Rentz has installed a variety of systems ranging from greenhouse operations to a remote high-speed camera set up in Arkansas to catch images of the elusive Ivory-Billed Woodpecker.

“The most exciting part is that I am helping to build a new industry in Missouri and build a more sustainable future for our children,” Rentz said. “With the good-paying jobs that come with the industry, Missouri has a bright future.” 🌞

Kerry Cordray and Kathy Deters are public information coordinators for the Department of Natural Resources.



FILL 'ER UP ... ON FRIES



by Andrea Morrow
photographs by Scott Myers

What do Twinkies, french fries, glycerin and a farm tractor have in common? It might surprise you to find out that all four are part of a waste-oil-to-biodiesel process at Truman State University. Enterprising students and their professors are taking waste vegetable oil and powering up the university's farm vehicles and creating a new cost-saving form of sustainable energy.

In fall 2007, a collaborative project was developed between the agriculture science senior practicum class of Tom Marshall, Ph.D., and Truman State University's student chapter of the American Chemical Society, with Barbara Kramer, Ph.D., as its advisor. The original plan was to create a small amount of biodiesel. Some students wondered if they could take what they learned making that small amount and do something much bigger.

"Some of the chemistry majors and the agriculture majors really liked this project," Kramer said. "The chemistry kids talked a lot about it, but the agriculture kids got it rolling. If you want something done, go to the agriculture guys; they'll get it going!"

The first step was to gather the materials to make the biodiesel. Students first looked close to home and began collecting waste vegetable oil from campus dining halls and restaurants in the area, including one of their first supporters, the Dukum Inn. The process of making biodiesel includes filtering the oil and processing the oil with chemicals in order to convert the oil into biodiesel. This process can take 48 hours – 24 for the chemical reaction and 24 for cleaning and drying the fuel.

The next step wasn't so simple: Where would they get the money to purchase equipment and chemicals?

Josh Hirner, 2009 Truman State graduate, and advisor, Barbara Kramer, Ph.D., give a tour of the Bulldog Biodiesel processing site. (Inset) Jars on display show the transformation of waste oil to biodiesel, including the required chemicals and glycerin by-product.



Dr. Kramer explains the waste oil collection process outside an on-campus dining hall.

In 1990, the legislature passed Senate Bill 530, requiring the state to divert 40 percent of its waste stream from landfills. Tonnage fees were collected from waste haulers to support education and provide grants to achieve the 40 percent diversion goal. At the same time, the state was divided into 20 solid waste management districts, created to foster regional cooperation among cities and counties. Part of the districts' duties includes awarding grants to local entities for waste reduction purposes and monitoring the projects funded.

Kirksville, home to Truman State University, is located in the Northeast Missouri Solid Waste Management District, also known as Region C. Marshall, Kramer, and some of the students approached Region C for grant funds to purchase the necessary chemicals and equipment to take the biodiesel project to a larger scale. Region C approved the grant request, and the Missouri Department of Natural Resources' Solid Waste Management Program provided more than \$34,000 to the university's Bulldog Biodiesel project.

With these funds, Bulldog Biodiesel purchased a 50-gallon Bio Pro processor to increase the volume of biodiesel they produce

each year, as well as the chemicals needed to properly process the waste vegetable oil.

"We are pleased to partner with Truman State University and the Bulldog Biodiesel project," said Nate Walker, executive director of the Northeast Missouri Solid Waste Management District. "We believe this project will inspire future good works toward the further development of green alternative fuels to address solutions to this important environmental issue."

The benefits of biodiesel are many and varied. The miles-per-gallon ratio compared to traditional petroleum diesel fuel is very similar. However, there are problems using pure biodiesel fuels during cold weather. During the colder months of the year, the biofuel may congeal or gel. The project participants are conducting research to determine which chemical fuel additives will minimize the gelling.

"We've been sent all kinds of chemical samples," said Marshall, the agricultural science professor, as he pointed to a table full of bottles containing the various fuel additives. The students tested the gel points of the fuel by placing samples in the farm freezers where they are stored and cooled. "Unfortunately, none of them seem to work very well," he added. Through further experimentation, the group found that mixing 30 percent biodiesel with 70 percent petroleum diesel in the winter months helps reduce the fuel's tendency to turn into a gel.

As with many projects, trial and error have served as the best teacher. Originally, the waste vegetable oil was picked up around campus and at local restaurants in 55-gallon drums using a pickup truck with a lift gate. This required the students to pick up the heavy, grease-covered barrels from the dining facilities, replace them with new barrels, and then lift them again in order to empty them at the processing facility. A few creative students, under the direction of Bill Koontz, the university farm manager, found a better way.

A new tank will hold twice the capacity of the drums and has a vacuum system that will drain the barrels without lifting them. Once the tank is full, the vacuum can be reversed at the processing facility to empty it.

"This system is going to make everyone's job so much easier," Marshall, said. "We've been looking forward to this for a long time, and we're very excited to use it." Marshall can hardly contain his excitement

as the new 110-gallon tank, painted with the Bulldog Biodiesel logo, is loaded onto the pick-up truck.

Currently, the program creates enough biodiesel to power the university farm vehicles, but their goal is to produce 5,000 gallons in the upcoming year and be able to fuel all campus diesel-powered vehicles. Ultimately, they hope to purchase a biodiesel-powered shuttle bus that would take students to shopping centers and Kirksville-area restaurants.

One mission of Bulldog Biodiesel, and a constant campus goal, is waste reduction on campus. A byproduct of the biodiesel-making process is glycerin. The waste glycerin is made into soap by the students and then sold at fried food fundraisers by the newly formed biodiesel club, or it can be composted at the university composting facility. In keeping with the waste diversion goal, 2,100 gallons of waste oil, or eight tons, have been diverted from landfills since September 2008.

If the group accomplishes its goal of generating 5,000 gallons of biodiesel in 2009-2010, the university will save an average of \$15,000 a year if petroleum diesel stays around \$3 per gallon. Besides the economic impact, the environment will greatly benefit from the biodiesel project. Tons of waste vegetable oil will find a new purpose and stay out of landfills, while the glycerin byproduct not used for soap is composted at the university composting facility.

“The Bulldog Biodiesel project helps the environment, and helps local restaurants

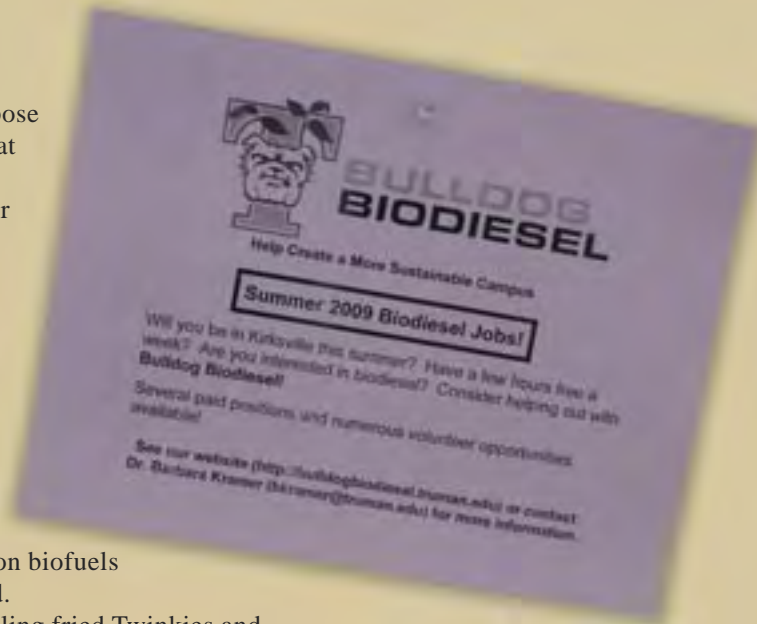
and the university food services dispose of their waste oil at no cost to them,” said DNR Director Mark Templeton.

For now, the group continues to look to the future and ponder its next project. In the spring 2010 semester, the first university class focusing on biofuels will be introduced.

Fundraisers selling fried Twinkies and Snicker bars by students of all educational backgrounds and concentrations will continue. Hopes for a biodiesel-powered shuttle bus continue, as does a goal of finding funds to purchase solar panels and a biodiesel generator. Their goal is to power up the facility that creates the biodiesel and “close the loop” to make the process truly eco-friendly and energy-saving. And it all started with a tiny sample of biodiesel.

Josh Hirner, a senior chemistry student and project manager, said, “It’s absolutely amazing to see something that started as a simple concept in your mind and on paper finally come to fruition.” 🌞

Andrea Morrow is a public information specialist with the department’s Solid Waste Management Program.



Built by students, with the help of some family members, this storage tank will sit on the waste oil collection truck for transportation to the facility. It is then pumped out for the biodiesel making process.





(Above) The Buehler Building, along with the DGLS Annex, not pictured, are two of the most energy-efficient buildings operated by Missouri state government.

(Below) Double-pane, solar Low-E windows help increase energy efficiency. The building's overhang, part of its 1963 design, shades the windows in the summer and allows natural light into the building during winter months.



The Missouri Department of Natural Resources' Division of Geology and Land Survey, headquartered in Rolla, now occupies two of the most energy-efficient office buildings operated by Missouri state government.

The division is housed in the Buehler and Annex buildings on Fairgrounds Road. In recent years, these buildings have seen as much as a 40 percent reduction in energy use and at the same time, an increase in both usable space and occupant comfort.

"These two buildings were not always the high performers they are today," said Joe Gillman, DGLS director and state geologist. "The setting in 2004 was certainly not one of energy efficiency."

The Buehler Building, faced with Carthage Marble, was built in 1963 on land donated by the Rolla Chamber of Commerce. The facility's heating system was supplied by the original boiler that was converted from oil to natural gas at some point during its 40-plus years of operation. Two centrifugal chillers that had persistent problems during summer months supplied cooling. To make matters worse, the pneumatic control system that controlled valves and dampers throughout the building had constant leaks that greatly limited its effectiveness. Other issues included lighting that comprised more than 10 different light-fix-

ture scenarios and single-pane windows that produced chilling drafts in the winter.

The Annex Building, built in 1968, served as office and warehouse space in which drill core and other rock samples taken from around the state were stored and cataloged. When the McCracken Core Library and Research Center was built with private donations in 1989, core samples were relocated there and the warehouse needs of the Annex Building were significantly reduced.

"With all these issues, the need to develop and implement a capital improvement project became a high priority, not only for the division but also for the department and the state's Division of Facilities Management Design and Construction," said Frank Cunningham, a former energy engineer with the department's Energy Center. The original concept was to replace the heating and cooling systems in both buildings with similar systems – assumedly the simplest and quickest solution.

However, the cost to do this far exceeded appropriated funds. Department management and staff believed all along that improving the energy efficiency of the building was important and should be a high priority. They persisted with the idea of installing a ground source heat pump (GSHP) system. The department's Wellhead Protec-

tion office is also in the building and regulates ground source wells.

“During the design process, staff also pushed to have an energy study performed, comparing the economic impact of a conventional system to that of a GSHP system,” said Cunningham. Kirk Mescher of CM Engineering, Columbia, was hired to do the energy study. The firm has extensive experience with GSHP systems. “The results were astounding and prompted the state’s facilities management and design construction staff and the department to proceed with a GSHP system,” Cunningham added.

Partnering with architects Simon Oswald Associates, also of Columbia, CM Engineering was then selected to design and manage the replacement of the Buehler Building’s heating, ventilation and air conditioning systems. During the initial design phases, it was determined that the original amount budgeted for the HVAC replacement was more than required. This afforded the opportunity to upgrade the Annex Building’s HVAC system, as well as address other energy-efficiency measures that had been identified for the building.

As a result, both buildings received new HVAC systems, new occupancy lighting sensors, efficient fluorescent lighting, new double-pane windows, and wall insulation that also helped reduce the size and cost of the heating and cooling systems.

The consultants also designated the warehouse space as new office space that would be completed as the first phase of construction. This space served as a temporary area for staff displaced during the renovation of existing space in the Buehler Building. This not only helped save staff time but it also saved money that would have been used to lease temporary office space. Once completed, this new office space also provided a conference room to accommodate all staff.

“Our ground source option truly showcases the benefits of ground source technology, and these energy-efficient measures could be employed by businesses, schools and citizens,” said Gillman. “The 40 percent reduction in costs ... benefits both taxpayers and Missouri’s environment.”

These improvements in state facilities may soon become more common since Gov. Jay Nixon signed Executive Order 09-18 during the Missouri Energy Summit held at the University of Missouri in April 2009.



The order directed state agencies to reduce building energy use by two percent annually for the next 10 years. Nixon said conservation measures would include weatherization of buildings, replacement of inefficient light fixtures with energy-efficient ones and implementation of more efficient means of heating and cooling state government buildings, among other measures.



(Above) More efficient fluorescent lighting has replaced old fixtures and sensors turn lights on or off when people enter or leave the room.

(Left) Joe Gillman, director of the Division of Geology and Land Survey, stands near one of two wells that are part of the ground source heat pump system installed in 2003 to heat and cool the Buehler Building. The wells are 900 feet deep and water is circulated between them. The system is reversed to meet seasonal needs.

To learn about energy-efficiency measures you can take and funding opportunities through the department’s Energy Center, visit [dnr.mo.gov/energy]. You are welcome to visit the Geology and Land Survey division at 111 Fairgrounds Road in Rolla, or online at [dnr.mo.gov/geology]. ☀

Hylan Beydler is division information officer for the department’s Division of Geology and Land Survey in Rolla.

Missouri Lake Monitors Needed



The Department of Natural Resources Water Protection Program is seeking monitors who live near a lake for a new lake monitoring program. "Sedimentation and eutrophication are the two biggest problems we see in Missouri lakes," said DNR environmental specialist John Ford. "We would like to have a group of volunteers willing to monitor the smaller lakes that are not already being monitored by the Lakes of Missouri Volunteer Program."

Monitoring would include taking temperature and Secchi disk measurements. Requirements include having a boat or other means to monitor the deepest part of the lake and be willing to monitor once or twice a month during the warm season. Staff will come to your site to train you and will provide the Secchi disk and other monitoring equipment.

If interested in volunteering, contact Susan Higgins at 573-526-1002 or [susan.higgins@dnr.mo.gov].

Geologist Gillman Takes Quake Post

State Geologist Joe Gillman, director of the department's Division of Geology and Land Survey, was selected as coordinator for the Association of Central United States Earthquake Consortium.

CUSEC is a multi-state partnership formed to mitigate disasters and save lives. Since 1992, state geologists from Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Tennessee and Missouri have worked closely with partners in federal government and within member states to increase awareness of the earthquake risk in the New Madrid Seismic Zone. In cooperation with the U.S. Geological



Survey, the CUSEC state geologists provide scientific data about the NMSZ, mapping for risk assessment, potential earthquake risk for citizens, as well as provide various geologic information related to earthquakes.

The NMSZ, located in southeastern Missouri, northeastern Arkansas, western Tennessee, western Kentucky and southern Illinois, is the nation's most active seismic zone east of the Rocky Mountains. More than 200 small earthquakes occur in the zone each year. In 1811-12, the NMSZ produced a series of earthquakes estimated at magnitude 7.0 or greater.

There is broad agreement in the scientific community that a continuing concern exists for a major destructive earthquake in the NMSZ.

For more information about the CUSEC, visit [cusec.org].

February is Earthquake Awareness Month in Missouri, visit [dnr.mo.gov/geology] for related events.

New Store at Roaring River

Area residents and visitors to

Roaring River State Park, near Cassville, now have the convenience of a new and expanded park store, built by concessionaires Jim

and Carmen Rogers in partnership with the Department of Natural Resources. The Rogers will operate the store, which will become the department's property at the end of the concession contract.

The 5,169-square-foot facility more than doubles the space available for retail items compared to the previous store. It will provide a variety of merchandise including fishing tackle and equipment, souvenir items, groceries and other convenience items for campers and visitors.

The structure's location at the intersection of Highway 112 and Route F, below the Emory Melton Inn and Conference Center, makes it easy to access from various parts of the park.



The improved access and newly expanded grocery items also make it convenient for local residents to stop by and purchase basics like bread and milk.

Exhibit on Loan to Geology Museum

Visitors to the Ed Clark Museum of Missouri Geology, Rolla, will find a new, interactive earthquake exhibit that will be of interest to both children and adults interested in learning about seismically active Missouri. Active Earth Kiosk is an interactive, computer-based educational tool that provides information about plate movement tectonics, earthquakes, volcanoes and tsunamis.

The Active Earth Kiosk is being made available to the department's Division of Geology and Land Survey through Incorporated Research Institutions for Seismology (IRIS), a university consortium sponsored by the National Science Foundation. The kiosk will be on loan for the years 2010-2011.

"We are very appreciative that IRIS chose us to host the Active Earth Kiosk," said Joe Gillman, state geologist and DGLS director. "We are especially pleased to have the kiosk as we lead up to and observe the 200th Anniversary of the New Madrid Earthquakes of 1811-1812."

Recipients are eligible to receive the kiosks while the U.S. Transportable Array is in their state. The Transportable Array is a large, traveling network of 400 high-quality, portable seismographs that are being placed in temporary sites across the United States. Western Missouri will receive their seismographs in 2010 and the remainder of the state's array will be deployed in 2011.

The 1811-1812 earthquakes were the most intense intraplate earthquake series to have occurred in the contiguous U.S. An intraplate earthquake is an earthquake that occurs in the interior of a tectonic plate, whereas an interplate earthquake is one that occurs at a plate boundary, such as those occurring in the state of California. A

good deal is known about California earthquakes, but much remains to learn about earthquakes in Missouri.

The Ed Clark Museum of Missouri Geology is housed with the Division of Geology and Land Survey at 111 Fairgrounds Road in Rolla. Museum tours are free of charge from 8 a.m.-5 p.m. weekdays. The museum will be home base for the display the greater part of 2010 and will travel to other sites throughout the state in 2011. For more information about the display visit [dnr.mo.gov/geology].

Houston Gets First ARRA Sewer Grant

The Department of Natural Resources has awarded the city of Houston in Texas County a \$1,750,000 grant and a \$1,750,000 loan through the American Recovery and Reinvestment Act of 2009. In addition, DNR is also awarding the city a \$500,000 Rural Sewer Grant through a water pollution control bond to help improve the quality of treated wastewater that is discharged to waters of the state and protect human health and the environment. Houston is the first city in Missouri to receive funding for wastewater improvements through the Recovery Act.



The city will use the grants and loan to construct wastewater treatment facility improvements and perform rehabilitation of the collection system. The wastewater system construction consists of a new oxidation ditch, two 50-foot diameter clarifiers, sludge holding tank, UV disinfection system, triplex pump station, bar screen and sludge truck. The rehabilitation includes the replacement of four pump stations and repair of some sewer lines and manholes. The project is estimated to cost \$4 million and is expected to be completed in November 2010.

For more information, contact the department's Water Protection Program, Financial Assistance Center, at 800-361-4827.



environmental notes

Going Out Green

Tired of the word "green" being used to promote everything from buildings with reduced environmental impact to vehicles with high gas mileage – or other products and practices said to improve our overall sustainability?

Now you may be tired to death of this one – green burial. Launched in England in 1993 as a means of preserving natural areas, saving money and allowing cemeteries to be more environmentally friendly, natural burials are said to be catching on worldwide.



According to The Centre for Natural Burial [naturalburial.coop], a traditional 10-acre cemetery could contain enough coffin wood to build more than 40 homes, nearly a thousand tons of casket steel and twenty thousand tons of concrete for vaults. Across North America, enough metal is diverted into coffin and vault production each year to build the Golden Gate Bridge and enough concrete is used to build a two-lane highway from Toronto to Montreal – and back again.

Formaldehyde, the primary ingredient in embalming fluids, is another concern. In North America, nearly a million gallons of embalming fluid is buried every year. Some of which has the potential to eventually leach out and run into surrounding soil and groundwater.

The Centre for Natural Burial Web site says, "Natural burial takes the concept of 'ashes to ashes, dust to dust,' to heart with a simple, natural and meaningful alternative to the wastefulness and extravagant consumption of the traditional funeral. A natural burial is about completing the circle of life. What could be more beautiful than to become a part of nature? Perhaps a molecule from your body will end up in a berry that a bird eats." Most of us would probably prefer a more meaningful future for our molecules, but you get the idea.

The Centre also worries that by choosing cremation, people may become air pollution. "The major emissions from crematories include: nitrogen oxides, carbon monoxide, sulphur dioxide, mercury vapor, hydrogen fluoride, hydrogen chloride, and other heavy metals, including persistent organic pollutants," their site says.

In Wisconsin, the Trust for Natural Legacies Inc. [naturallegacies.org] is a non-profit land trust that preserves and restores natural areas by owning, operating and promoting nature preserves. The trust also is working to establish cemetery nature preserves and support others in similar efforts throughout the Midwest.

At present, one natural burial site each is planned for Wisconsin and Minnesota. There are 13 natural burial cemeteries across the U.S. and six more, including the Midwestern sites, in planning stages. The trust is seeking potential green cemetery sites of 40-100 acres, within a 30-45 minute drive of major metro areas. Sites should include a mix of prairie, wetland, woods or other native habitats.

The first green cemetery in Missouri is being developed west of Columbia to offer cheaper burials and an environmentally friendly alternative to traditional burials. Green Acres will follow burial criteria established by the Green Burial Council, a nonprofit organization based in Santa Fe, N.M. Their Web site can be accessed at [greenburialcouncil.com].

News Briefs

\$200,000 Grant for Jacks Fork

Gov. Jay Nixon announced the Department of Natural Resources



has awarded a \$202,608 grant to Top of the Ozarks Resource Conservation and Development Inc. for the Redesigning the Jacks Fork River Project near Eminence, in Shannon County.

The group will use the grant to address elevated bacteria levels in the Jacks Fork River on several fronts. The Jacks Fork River is a major recreation resource for canoeing, fishing, swimming and trail riding. A 7-mile stretch of the river was placed on the state's 2002 303(d) list of impaired waters for excess levels of fecal coliform bacteria.

The department developed a Total Maximum Daily Load (TMDL) to address the impaired section of the river. Section 303(d) of the Clean Water Act requires states to list impaired waters and develop a TMDL for all waters on the list. The TMDL for the Jack's Fork River Project is available on the department's Web site at

[dnr.mo.gov/env/wpp/tmdl/2681-jacks-fork-r-tmdl.pdf].

The department's TMDL data indicated there are several potential non-point sources of fecal coliform bacteria in the Jacks Fork watershed. These sources include failing or inadequate on-site septic systems, wildlife, land application of animal manure and poultry litter, grazing animals, urban development, horse trail rides and recreational use.

The Top of the Ozarks RC&D and partners will provide a match contribution of \$135,072 during the life of the project bringing the total cost of the project to \$337,680. Contributing partners include Jacks Fork River Watershed Steering Committee, the National Parks Service – Ozark Scenic Riverways, the Department of Natural Resources and local Stream Team volunteers and monitors.

The U.S. EPA, Region 7, through the department, has provided partial funding for this project under Section 319 of the Clean Water Act. The department's Water Protection Program will administer the grant funds.

For more information, contact the department's Water Protection Program at 800-361-4827.

Nixon Announces Water Loans, Grants

Gov. Jay Nixon announced the Department of Natural Resources will



provide communities with loan and grant funds to support the Clean Water Initiative for water and wastewater improvements. The sale of \$50 million in bonds in November 2007 allows funding for the following projects.

The village of St. Elizabeth in Miller County has received \$1,300,000 in wastewater loans and \$1,273,785 in wastewater grants. The village will use the loans and grants to construct a new wastewater collection and treatment system and is expected to be completed in July 2010. St. Elizabeth will provide matching funds.

Public Water Supply District No. 8 in Platte County received a \$444,800 drinking water loan through the State Revolving Fund. The district will use the loan to construct a new elevated water storage tank and water main improvements. The project is expected to be completed in January 2011.

Taney County PWSD No. 2 received a \$500,000 grant for water main re-

Some time back, I read an article in one of the older issues of your magazine about the New Madrid Fault. The issue was torn up and part of that article was missing so I wasn't sure exactly what to request. I wrote you with the general information and you sent me that story and past stories on the topic.

Thank you very much for those articles and the regular issues I receive. The stories are helpful and your magazine is very informative. I hope funding allows you to continue your work in years ahead.

Gary D. Sonnenberg
Charleston

I enjoy your magazine. My brother-in-law and his son run a cedar saw mill in Bradleyville that is interesting in its use of the entire wood and by-products without waste. Logs are used to

Letters



make lumber and square posts. The lumber is used for closet linings, cedar chests and novelties. Even the sawdust is sold and the bark is used for other products. The scrap lumber goes to a handicapped workshop. It is a great recycling set-up and a model for other operations. His father operated a mill before him.

Linda Worster
Forsyth

Letters intended for publication should be addressed to "Letters," *Missouri Resources*, PO Box 176, Jefferson City, MO 65102-0176 or faxed to (573) 522-6262, attention: "Letters." Please include your name, address and daytime phone number. Space may require us to edit your letter. You also can e-mail *Missouri Resources* staff at [moresdnr@dnr.mo.gov].

placements and well house improvements. The funds will be used in conjunction with a \$750,000 loan from the U.S. Department of Agriculture Rural Development Program and is expected to be completed in April 2010.

The village of Preston in Hickory County was awarded \$895,766 in wastewater grants to construct a new wastewater collection and treatment system. The project is scheduled to be completed in July 2010. The village will provide matching funds to pay for the project.

The Metropolitan St. Louis Sewer District has taken out a \$23 million low-interest loan to be used for three different construction projects. The Lemay Wastewater Treatment Plant will be improved to provide additional treatment capacity for wet weather flows. The Creve Coeur Creek project consists of rehabilitating a 20-year-old pump station. System-wide investigations will be performed to identify inflow and infiltration sources for the third project.

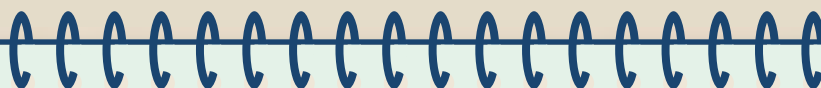
The department's Water Protection Program will administer the loan and grant funds.

For more information, contact the department's Water Protection Program, Financial Assistance Center, at 800-361-4827.

Air Pollution Grants Assist Metro Regions

The Missouri Department of Natural Resources has awarded four subgrants to fund operation of air programs across the state. The grant award total of \$2,329,399 is a combination of federal and state dollars.

The city of St. Louis Department of Health will receive \$888,278; St. Louis County Health Department \$681,453; Kansas City Health Department \$483,057; and the Springfield-Greene County Health Department will receive the remaining \$276,611. The local agencies will also provide matching funds to supplement these awards.



Stream Team Notebook

Kayak Swarm Wins Ambassador Award

Jim and Dianne Darlington were recently honored as the 2009 recipients of the Stream Team Ambassador Award for Volunteer Water Quality Monitoring. Over a period of several months, a group called the Kayak Swarm photographed the banks of the Meramec River and collected readings on turbidity, pH, water temperature, conductivity and phosphate every mile – from mile one to mile 201.



DNR photo by Susan Higgins

Dianne and Jim Darlington record environmental data on the Meramec River as they lead the Kayak Swarm Stream Team volunteer water quality monitoring project.

Along with the Darlingtons, trained monitors included Bernie Arnold, Brian Waldrop and Darlene Haun. At each monitoring point, a GPS reading was taken so tests could be repeated at the same locations in the future.

This modern day Corps of Discovery established an incredible amount of scientific information on one of Missouri's most popular rivers. It also drew the attention of local media to the need for preserving the beauty and value of the Meramec. It took months to accomplish, but the results will leave a legacy for others to follow. Other Stream Team volunteer water quality monitors may think that Jim Darlington and his Kayak Swarm are a hard act to follow. But Stream Team sponsors hope they will prove to be an inspiration to those who love science, have an appreciation for the outdoors and a sense of adventure.

Priscilla Stotts, a Stream Team coordinator for the Department of Natural Resources, said of the Kayak Swarm: "The Darlingtons have come up with a unique way to involve other citizens in protecting the Meramec River by creating a 'scientific adventure' in which everyone can participate. The best part of this project is that someone else will be able to come along in the future and use the GPS points to collect data at the very same locations. We will be able to compare changes in the Meramec River over time."



Federal funds are passed through to the local agencies to perform commitments outlined in the State Local Agreement and the department's agreement with the U.S. Environmental Protection Agency. These grants will fund local operations through September 2010.

The department is committed to working closely with communities to assist with funding efforts that support air quality projects as well as provide financial savings.

For more information concerning these subgrants or other air pollution issues, please contact DNR's Air Pol-

TIME EXPOSURES



In July 1909, this panoramic photo of the Standard Oil refinery at Sugar Creek was taken by William H. Wiseman. It is now part of the Library of Congress collection of panoramic photos.

The refinery was only five years old when this photo was taken but it grew to fill 450 acres along the Missouri River at Sugar Creek – a source of supplies for pioneers traveling trails to the west. Today, only a fraction of the site is still in use but it has become a symbol of the cooperative efforts of industry, community and government to clean up and reuse petroleum processing facilities.

The Bluffs at Sugar Creek business park project has emerged from decades of pollution and litigation with input from BP Amoco, formerly Standard Oil, the City of Sugar Creek, U.S. EPA and the Missouri departments of Health and Senior Services and Natural Resources.

Photograph from Panoramic Photographs, American Memory, Library of Congress.

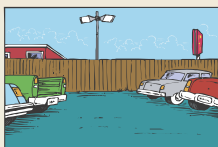
Send your photo to "Time Exposures," c/o Missouri Resources, PO Box 176, Jefferson City, MO 65102-0176. Original photos will be returned via insured mail. Pre-1970 environmental and natural resource photos from Missouri will be considered. Please try to include the date and location of the picture, a brief description and any related historic details that might be of interest to our readers.

lution Control Program at 800-361-4827 or through the department's Web site at [dnr.mo.gov/env/apcp].

Saving Energy; Reducing Glare

Lighting equipment manufacturers and energy efficiency organizations have announced agreement on a congressional legislative package that would create new minimum efficiency standards for many types of outdoor lighting products. If enacted, the new standards would reduce U.S. lighting energy use by about 24 to 42 billion kilowatt hours annually, equivalent to the annual output of three to six new 1000-megawatt power plants (the typical size of a new nuclear plant).

The agreement was reached by the National Electrical Manufacturer's As-



sociation; the American Council for an Energy-Efficient Economy; Natural Resources Defense Council; Alliance to Save Energy; Appliance Standards Awareness Project; and Pacific Gas & Electric Company, a major utility.

The agreement establishes initial efficiency standards for outdoor pole-mounted lighting fixtures, then calls on the U.S. Department of Energy to quickly set revised standards. These fixtures primarily light roadways and parking lots. The agreement also requires double-ended halogen lamps – a type of high-wattage incandescent lamp that is used outdoors – to meet specific efficiency requirements and prohibits sales of mercury vapor lamps starting in 2016. New mercury vapor fixtures and ballasts were already prohibited in a 2005 law.

ACEEE estimates that the initial standards will save about 12 billion kilowatt hours per year. The revised

lighting standards could increase savings by 12 to 30 billion kwh per year for total savings of as much as 42 billion kwh per year. This is roughly enough power to meet the total needs of more than 3.6 million typical in the U.S. households.

"The agreement will also improve lighting quality from outdoor fixtures, since the most stringent standards apply to fixtures with high glare and light trespass," said Jennifer Amann. Amann serves as the director of ACEEE's Buildings Program.

More information is available at [aceee.org/press/0911outdoor.htm].

For news releases on the Web, visit [dnr.mo.gov/newsrel/index.html]. For a complete listing of the department's upcoming meetings, hearings and events, visit the department's online calendar at [dnr.mo.gov/calendar/search.do].

Cycles Unlimited Pulling Into the LEED

Cycles Unlimited, a Springfield bicycle sales and service business, became that community's second building to earn the Leadership in Energy and Environmental Design Gold certification in May 2009. The city's Discovery Center won the same LEED® award in April 2007.

Cycles Unlimited has been in their new building for two years. Planning the low environmental impact building began two years before they opened, according to owner Ashley Burchfield.

"My wife is a building contractor who had been developing sustainable construction practices," he said. "I started helping her with ideas and when we decided to build a new store, voilà, we had plenty of information."

Burchfield also credits the Springfield consulting firm Environmental Management Services Inc. with helping guide the project through the extensive LEED standards required by the U.S. Green Building Council.

Since the LEED system was introduced in 2000, there have been nearly 20,000 projects registered worldwide. Certification is awarded on four levels through a point scoring system – with 110 points at the top. Platinum requires a minimum of 80 points, Gold needs at least 60, Silver is 50 and Certified is 40 points.

A LEED project such as Cycles Unlimited requires ongoing documentation to confirm sustainability in five categories: site development, water efficiency, energy and atmosphere, materials and resources and indoor environmental quality.

Tracking and documentation is where EMSI assumes a prominent role. Burchfield points out that as soon as a customer or visi-

tor drives into the parking lot, they are aware of the "green" nature of the site and building. Pervious paving in the lot allows storm water to seep in rather than run off. Water that does run off the building's roof is captured in a 3,500-gallon cistern to be used for landscape irrigation, cleaning and toilet operation. Shade trees and native vegetation are part of the site design.

Exterior lighting is solar powered and designed to reduce the light pollution that makes stars difficult to see over urban areas. A reflective roof and extensive insulation helps reduce cooling costs. Natural light provides 75 percent of internal lighting and 90 percent of the interior has a view of the outside.

During construction, more than 94 percent of waste materials were recycled. Recycled content materials also were used.

Consultants estimate that it costs about 4 percent more to construct a green building and certification fees add to the expense, but energy savings are estimated at around 30 percent.

"We have achieved as much of the energy and water savings as we expected," said Burchfield. "The performance of the building has been above our expectations."

More information on the Cycles Unlimited LEED project can be obtained from the business Web site at [cyclesunlimited.net].



photo by Ashley Burchfield

Cycles Unlimited

North Callaway High Takes Waste Out of E-waste

In the 2003-2004 school year, a dozen North Callaway High School students enrolled in a class designed to teach computer technology while providing technical support for the school district. The Technology Problem Solving class has grown to foster a statewide educational effort called Digital Outreach Missouri and a non-profit group, Missouri Computer Exchange. The programs take donations of nonworking computers for repair, upgrading and distribution. Among those getting computers are local faculty and staff, an afterschool program in Columbia, an elementary school in New Haven, an Audrain County emergency response team and even a system of orphanages in Uganda. And, the beneficiary list continues to grow.

Technology teacher David Hopkins reports that the technical support provided by students helps save the school district about \$18,000 per year in salaries alone. More than 200 computers and support equipment have been donated to the program. "Normally, the used cost of a computer is between \$150 and \$250," Hopkins said. "Most computers are replaced every two years, but many components can be used for up to 10 years."

In 2005, the students, known as Technology Problem Solvers, became a Microsoft Authorized Refurbisher. The class represented the only Missouri high school certified by the computer manufacturer to rebuild used computers. They also are certified to install Windows operating systems and provide them to students and non-profit organizations. Students joined the National Students Working to Advance Technology to provide computers and technical support for specific educational projects.

In 2006, the class partnered with Mid-Missouri Recycling in Columbia so computers could either be refurbished and given away or

recycled. "Everything goes somewhere," said Hopkins. "More than 70 computer systems were recycled, diverting more than a ton of electronics from the waste stream."

With students building their own computers and refurbishing classes being carried out during summer school, the Technology Problem Solvers also have been able to support a computer checkout program for 45 students. Seventy-five percent of those students did not have a home computer. Computers also are donated to needy students at other schools.

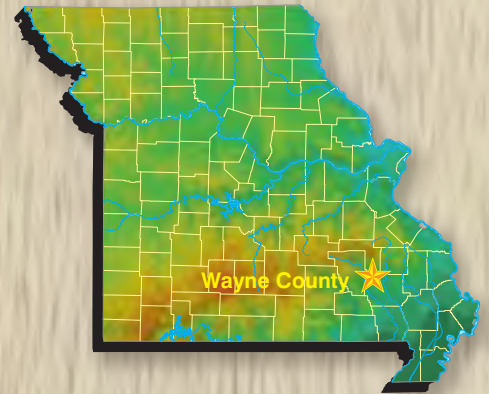
Honors and recognitions are piling up for Hopkins and his team of students. They have been honored by the Missouri Legislature, received the Ethel Percy Andrus Legacy Award for Innovation in 2008 and in 2009, received the Sea World / Busch Gardens Environmental Excellence Award. That award included a check for \$10,000 to support the refurbishing program. This recognition placed them among the top eight environmental programs in the nation, due to the nearly seven tons of e-waste they have kept out of Missouri landfills.

The Missouri Computer Exchange plans to apply for a solid waste management grant so Digital Outreach Missouri can be started in schools across the state.



photo by Justin Loucks

Colin Pashia, Kyle Walker and Nathan Dismang, with technology teacher David Hopkins (back).



Sam A. Baker State Park

by Michelle Soenksen
photographs by Scott Myers



(Top) The visitor center was originally a stable, built by the CCC in the 1930s.

Today, it houses exhibits that feature park history and natural attractions.

(Above) The Reynolds brothers of Sikeston observe one of the park's snakes on display at the nature center.

Sam A. Baker State Park is one of the oldest and most memorable state parks in the Missouri state park system. The resources that make a visit to the park unforgettable are the cultural, natural and recreational features.

Sam A. Baker State Park is a place of distinct natural history, beauty and value. Even before becoming a park, the area attracted people because of its grand peaks, clear streams and forest diversity. During

early historic times, the Osage Indians used the St. Francois Mountains and surrounding Ozark region for hunting. Some of the first pioneers to arrive in the area settled and built a homestead where the park is located today. Joseph Miller, one of the area's first settlers, mentioned that the surrounding beauty of the Ozarks made such an impression on him that he said to himself, "This is where I belong."

Sam A. Baker State Park was named after Missouri's former governor, Samuel Aaron Baker, who was born in Patterson, just south of the park. He taught in the rural schools of Wayne County and then served as principal and superintendent for several schools. He became governor in 1925 and began encouraging the development of the park soon after that. The first 4,000 acres cost the state only \$23,000 and in 1927, Sam A. Baker State Park was established.

The park embraces and maintains its strong roots in history and culture. The Civilian Conservation Corps (CCC) played a vital role in the development of the park. The New Deal Era, established by President Franklin D. Roosevelt during the Great Depression, allowed the first major construction to begin when the park became the site of Civilian Conservation Corps Camp No. 5 in June 1933. Many residents of surrounding communities were employed in the camp as part of the corps' Company 740, or other CCC units. Both the Civilian Conser-

vation Corps and Works Progress Administration completed several construction projects at the park, including bridges, water fountains, cabins, hiking shelters, a horse stable and dining lodge. A total of 31 buildings and a fire observation tower were constructed during this period.

Most of the stone buildings were constructed from the native Mudlick Dellenite, also called “blue granite.” The visitor and nature center is located in an old CCC building that was originally used as a horse stable, office and storage/shop area. Because of the integrity of the preserved CCC-WPA workmanship, the entire park has been designated the Sam A. Baker State Park Historic District in the National Register of Historic Places.

Sam A. Baker State Park is also a memorable park because of its natural resources. Today the park is a 5,324-acre showcase of rugged igneous bluffs, shut-in canyons, crystal clear waters, old-growth forests and diverse plant and animal life. For example, Baker is one of the few places in Missouri where an Appalachian species, the yellowwood tree, grows in its natural habitat.

The prominent feature at the park is Mudlick Mountain, an igneous dome covered by old-growth oak-hickory forest, glades and talus slopes. Located in the St. Francois Mountain range, it is one of the highest igneous domes in the state at 1,313 feet high. The park contains the Mudlick Mountain Wild Area, which makes up 4,420 acres of the park and is considered one of the largest wilderness preserves in the state park system. A portion of the wild area is designated as the Mudlick Natural Area, a pristine and natural part of the park. The 1,370-acre natural area’s igneous mountain dome, deep “shut-in” canyon and talus fields are quality examples of undisturbed natural landscapes.

Mudlick Hollow is a favorite hideaway where the headwaters of Mudlick Creek form shut-ins, pools and small waterfalls that protect rare plants. Big Creek, which runs through the park, has been designated an Outstanding Water Resource by the state, allowing the creek additional protection against pollution and other disturbances. Water quality is considered high and previous sampling records show that this stream segment should be recognized for its aquatic community significance. More than 30 species of fish have been recorded living in



Floaters travel the St. Francois River at Sam A. Baker State Park. (Bottom) The park entrance utilizes one of the many Civilian Conservation Corps buildings constructed in the 1930s.

Big Creek and many of them are known to only live in southeast Missouri streams.

Sam A. Baker State Park is a memorable park because of recreational activities. Big Creek and the St. Francois River are two waterways that provide miles of water fun and are a great place for swimming, canoeing and fishing for small-mouth bass, sunfish and catfish. Float trips of all kinds can be arranged through the park store.

Hiking is a good way to get out and explore the great outdoors at Sam A. Baker



(Top, right) Jeff Pinson, Jefferson City, embarks in his kayak for a day of fishing on the Big Creek.

(Middle) Michelle Soenksen, park naturalist, uses the outdoors as a classroom to explain the natural features of Sam A. Baker State Park.

(Bottom) Mike and Betty Jo Haywood and Tosha Harris of Wentzville, and Erica Ruble, Vulcan, look over the menu at the park's dining lodge.

State Park. The Mudlick Trail is a system of more than 20 miles that has been designated a National Recreation Trail and takes hikers on a journey into the St. Francois Mountain Region. Hikers can choose to stay overnight in one of the three hiking shelters built by the CCC between October and May or rough it in one of the two backpack camps located on the trail throughout the year.

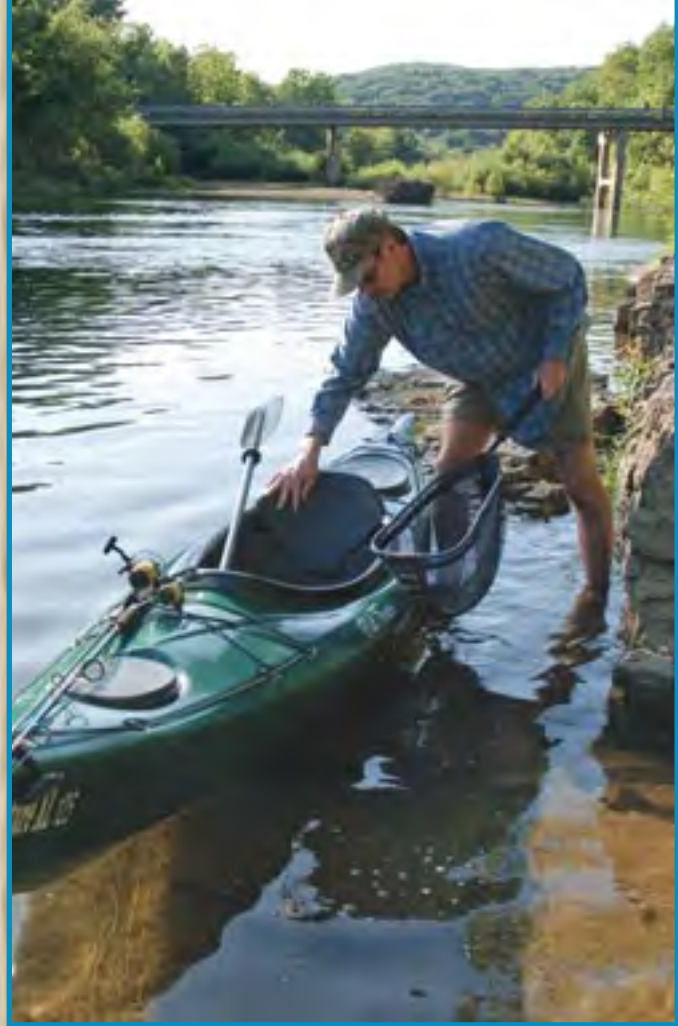
For those visitors who want to do less hiking, shorter trails are available. Trails are for hikers, backpackers and equestrian users. A 1.5-mile paved bike trail allows visitors to travel between campgrounds, park store and dining lodge.

Day users can take advantage of the three picnic shelters, playground and the visitor center, which offers information on the natural and cultural aspects of the park. Interpretive programs, including hikes, explorer programs and evening programs, are provided for visitors of all ages throughout the season. Overnight guests have several options, including 212 campsites with basic or electric hookups, an equestrian campground for those with horses, and 18 rustic cabins built by the CCC.

With its mission of preserving and interpreting the unique geology, beauty, and natural history of the southern St. Francois Mountains, the park provides a unique destination for families to explore the outdoors and a chapter of Missouri's history. In the initial effort to establish the park, Gov. Baker once indicated the park would be, "to make available for this and future generations something that was commonplace to the youth of forty years ago."

Sam A. Baker State Park is located four miles north of Patterson on Highway 143 in Wayne County. For more information on the park, call 573-856-4411 or the Missouri Department of Natural Resources toll free at 800-334-4946. You can also visit parks' Website at [mostateparks.com].

Michelle Soenksen is an interpretive resource specialist at Sam A. Baker State Park.





Cecil Boswell

DYEING TO FOLLOW THE WATER

by Hylan Beydler

photographs by Scott Myers

Imagine several sparkling streams run through your farm and one of the streams disappears into the ground (known as a losing stream). Additionally, a large cave exists under your property. Filled with fragile cave fish and salamanders, the ceiling of the cave often drips water in various places, forming pools on the cave floor. One Sunday, after returning with your family from church, you notice the water in one stream is very cloudy and appears to be polluted. If it is polluted, how would you determine where the water is going and whether the water from your streams enters the cave?

The answer is bugs! Yes, “bugs” could help solve the mystery. However, these bugs are not your garden variety. They are neither living things nor electronic listening devices – they are water tracing bugs, a.k.a. activated charcoal packets that absorb specialty dyes. Bugs are just one component of the arsenal of tools and technology used to protect the environment by Cecil Boswell, a technical assistant with the Missouri Department of Natural Resources’ Division of Geology and Land Survey’s Environmental Assistance Unit.

Boswell, a Provencal, La., native who works alongside geologists, was part of a team that recently placed non-toxic fluorescent dye in streams that may flow into Onondaga Cave. A National Natural Landmark that is open to the public, the cave is in Onondaga Cave State Park near Leasburg. Deep underground, a world exists that continues to change as water forms dripping stalactites, husky stalagmites and many other colorful deposits. The team conducted research using charcoal packets, along with state-of-the-art technology known as a SCUFA™ (Self-Contained Underwater Fluorescence Apparatus).

Cecil Boswell applies fluorescent dye to a stream in a Missouri cave. A scanning spectrofluorometer will then be used to detect the dye downstream and track underground water movement. (Inset) Boswell matches charcoal packets and water samples for eventual analysis.



“A SCUFA is a highly accurate, versatile, submersible fluorometer, a device used to measure dye, water temperature, and other characteristics of water as it passes through the device. Our SCUFA was brand new and we were testing ourselves as much as we were testing it on its maiden voyage,” said

A submersible spectrofluorometer is secured in a Missouri stream to help Cecil Boswell measure various environmental conditions in the water that passes through the device.

(Inset) The charcoal packets absorb waterborne dyes to determine the movement and characteristics of specific bodies of water.

Boswell, who had spent significant time in the office, acquainting himself with the SCUFA's hardware and its new accompanying computer software.

Many people rely on wells for their drinking water. The underground movement of water through caves and bedrock fractures is studied to prevent those wells from becoming polluted, in addition to identifying potential well pollution sources.

Besides completing water traces, Boswell also provides technical assistance to industry and researchers who are conducting other water traces. The department is responsible for the Missouri Water Trace Laboratory and the water traces performed within the state.

"Water tracers contribute to and use this database to aid them in their own traces," said Boswell.

He pinpoints locations collected by himself and others using a geographical information system. The GIS coverages are made available by the department to the public free of charge at the University of Missouri-Columbia's Missouri Spatial Data Center [msdis.missouri.edu/].

Boswell, who began his career in Rolla in 1996, may also be found assisting at sites of sinkhole collapse, illegal dump sites, wastewater treatment facilities, domestic waste lagoons and other geological and hydrological concerns.

Having recently completed a geology class at East Central University in Union, Boswell is continuing his education in business administration.

"I enjoy my job. It is rewarding knowing my work contributes to the good health of citizens and the protection of our environment." He especially likes his variety of duties, of which there is a good mix of field and office work.

"I have seen interesting regions of Missouri including many of her beautiful springs, hills and rock formations. The fact that I have been able to see most of our



state, including each corner and several points in between, is icing on the cake."

There are several areas of expertise to consider for a career with the department as a technical assistant, including assisting engineers, land surveyors, geologists, or hydrologists. Most require a high school diploma or GED and may demand four or more years of experience in drafting, computer-aided drafting or on-the-job training.

Other candidates include persons holding a bachelor's degree with a minimum of 15 earned credit hours in one or a combination of the following: drafting, engineering, engineering technology, geology, hydrology, earth science, geophysics, statistics or advanced mathematics.

Certain related training and experience may be substituted on a year-for-year basis for the required experience and education. For more information about career opportunities with the State of Missouri, visit [mo.gov/Employment].

Hylan Beydler is division information officer for the department's Division of Geology and Land Survey.

Winds of Innovation – *With a Blast From the Past*

by Philip J. Tremblay
photographs by Scott Myers

On June 2, 2008, both of the Missouri Department of Transportation's I-44 Conway rest areas, 10 miles west of Marshfield, were closed. Over the next 11 months, the old buildings were torn down and replaced by new, larger buildings. Picnic shelters, designed as Route 66-era storefronts, including a barber shop and diner, were constructed. Neon signs, in 1950s style, were placed in front of the main buildings on both sides of the highway. Recycled asphalt was used in the car parking areas. Playgrounds with slides and swings now include padding made from recycled tires. A pet walk area includes waste disposal containers and parking lot lighting has been improved. But one of the more noticeable additions are two 30-foot tall Windspire low-generation electric wind turbines.

At 30 feet tall by four feet, the barrel-type Windspire wind generators are used to supplement interior lighting at the welcome center buildings. The generators are manufactured by Mariah Power, Reno, Nev.

Windspires are designed to be low profile, but efficient in winds averaging 12 mph. The units operate with three sets of tall, narrow airfoils that catch the wind while spinning around a vertical axis. As the rotor turns, a generator turns wind energy into electricity. An inverter then converts the electricity from a direct current to an alternating current that can be used for buildings and homes. A 1.2 kilo-

watt generator can be installed for \$9,000 to \$12,000.

The Windspire will not work if a connection cannot be made to the power grid – the grid acts as a storage battery for the system. Mariah Power has future plans for an off-grid version of the Windspire. Information can be found at [mariahpower.com].

According to Doug Record, general services manager for MoDOT's



Low-profile Windspire wind generators are part of the green improvements made at the Conway Welcome Centers.

(Inset) Route 66-era greeting signs set a nostalgic theme for travelers on the four-lane I-44 highway.



central office, in addition to wind generators, the Conway center has ground source heat pumps with heat recovery for hot water; low volume plumbing fixtures, high efficiency lighting, motion sensors on plumbing fixtures and lights, circulation pumps on hot water lines and sand filter wastewater treatment. The renovation used \$10.8 million in federal highway system enhancement funds – not to be spent on state road building projects.

“MoDOT is always looking for ways to make

our facilities, operations and projects more efficient,” said Record. “Installing the Windspires at the Conway Welcome Centers joins a list of other green initiatives we’re implementing to preserve our resources and protect the environment.”

Phil Tremblay is a DNR public information coordinator and assistant editor of Missouri Resources.



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